

Mars Hill Windfarm Post-Development Second-Quarter Sound Level Study Peer Review

MARS HILL, MAINE

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Review Basis

UPC Wind Management LLC/Evergreen Wind Power LLC (UPC) operates a 28 unit wind facility along the ridge line of Mars Hill in Mars Hill, Maine. At the request of the Maine Department of Environmental Protection (MDEP) this continuing peer review is undertaken to provide expert opinion as to:

"Whether post-development reporting is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise(06-096 CMR 375.10) and

Whether the reports provide a reasonable basis upon which to determine compliance or non-compliance with the operational noise limits set forth in the Control of Noise rules and the variance given in Department Order L-21635-26-A-N/L-21365-TG-B-N, dated June 1, 2004."

The post-development ambient and operational noise studies were completed by Resource Systems Engineering (RSE)¹ in December 2006 (ambient), May 2007 (ambient and operation) and September 2007 (operation). Each section of the November 2, 2007 report will be generally critiqued unless detailed criticism is given.

1.0 Introduction

The stated objective of this sound level study is to compare wind farm operation sound levels with predicted estimates and evaluation of the ambient sound levels in the vicinity of the wind farm.

The Resource Systems Engineering (RSE) report of June 21, 2007 is referenced for additional details concerning previous portions of the sound level study.

2.0 Sound and Decibels

Informational

3.0 Site Description

Referenced to RSE report June 21, 2007.

4.0 MDEP Standards

Referenced to RSE report June 21, 2007.

¹ *Sound Level Study & Operational Sound Level Monitoring Maine Department Of Environmental Protection Order No.L-21635-26-AN*, Resource Systems Engineering, June 21, 2007, File 030625

5.0 Sound Level Model Estimates for Wind Farm Operation

Referenced to RSE report June 21, 2007.

6.0 Ambient Sound Levels

Referenced to RSE report June 21, 2007.

7.0 Operating Sound Levels

Operations sound testing began the afternoon of September 4 and continued for approximately 28 hours. Measurements were made under varying wind and operating conditions in order to determine by measurement sound levels at community monitoring positions during routine operation of the wind farm. Measured operations sound levels are compared to prior ambient and predicted sound levels.

Operation sound level estimates were calculated using, "ambient sound levels... from typical hourly L_{Aeq} readings during periods of the May 2007 operations testing when winds were light or calm and wind turbines were not operating"².

7.1 Measurement Procedures

Stated primary objective: to measure wind farm levels at nearby protected locations during conditions when the sound from the wind farm is most noticeable.

Monitoring site relocations seem reasonable and consistent with objectives. Five of the seven monitoring stations were also assessed for meteorological conditions with portable MET stations. Wind data was measured at a height of 8 to 10 feet above grade and concurrently on windmill towers.

Sound level measurements were periodically observed by field technicians.

7.2 Measurement Results

The last paragraph on page 4 states, "surface wind speeds at the five portable met stations generally showed minor fluctuations, particularly when averaged over a 10 minute period. This would be expected since these monitoring positions were ***purposely located at points partially shielded from wind by vegetation*** and terrain in order to reduce the contribution of non-wind turbine noise." (Emphasis added)

The 1st four paragraphs following Figure 7 lead to the statement:

² Sound Level Study Ambient & Operations Sound Level Monitoring 2ND Quarterly Report Maine Department Of Environmental Protection Order No.L-21635-26-AN, Resource Systems Engineering, November 2, 2007, File 030625

“The contribution of ambient sound levels during 2nd quarterly testing is estimated from typical hourly L_{Aeq} readings during periods of the May 2007 operations testing when winds were light or calm and wind turbines were not operating. This is a very conservative approach to estimating ambient sound levels that are likely to occur during periods of significant Wind Farm operation. Sound level monitoring results and field observations from December 2006, May 2007 and September 2007 indicate that ambient sound levels during wind conditions required for significant Wind Farm operation are generally higher than estimated by this method.”

Prior ambient sound level measurements during conditions required for significant wind farm operation (December 2006 & May 2007) were not conducted in a technically satisfactory manner, as previously discussed in EnRad Consulting report, November 21, 2007. The "... typical hourly L_{Aeq} readings during periods of the May 2007 operations testing when winds were light or calm and wind turbines were not operating" are essentially the only technically satisfactory ambient measurements reported.

"To calculate the wind farm sound level at each position, the estimated ambient sound level from non-Wind Farm sounds based on May 2007 readings was subtracted from measured L_{A50} sound level readings for these periods." The data found in Appendix IV indicates generally identical hourly L_{Aeq} and L_{A50} nighttime values (stable atmosphere).

7.2 Short Duration Repetitive and Tonal Sounds

7.3 Operating Conditions and Wind Predictions

8.0 Findings and Recommendations

The September 2007 operation sound measurements were recorded "during wind conditions exceeding the predicted mean wind speeds with wind from predicted predominant direction".

"Similar to Wind Farm sound levels, ambient sound levels vary with wind speed. At each of the monitoring positions, sound levels from Wind Farm operations were within the range of ambient sound levels. Due to their lower elevations, wind speeds at the monitoring positions are typically five to ten miles per hour less than at the turbine hubs. As shown by second quarterly results, this difference can increase depending upon the general wind direction, wind gradients, and amount of blockage by the terrain and vegetation. At monitoring positions where wind turbine sound was more prominent, the winds were generally light compared to wind incident at the turbine hubs. In these instances, measured sound levels from the Wind Farm were above sound levels from other sources. At the same time, leaf noise was often more audible during 2nd quarterly testing, due to the dominant higher frequencies as shown in Figure 7-1."

RSE recommends to the UPC Wind additional sound level measurements of wind farm operations during fall and winter periods using ground level anemometers at measurement positions.

RSE recommends UPC Wind should continue to provide measurement results to GE and for further evaluation of turbine performance and additional sound reduction options that may be available to address specific operating conditions.

Conclusion - (Peer Review)

This second-quarter operating level sound study was improved by the use of 5 METS stations recording surface (8-10' above grade) meteorological conditions at sound monitoring locations. Measurement locations were "***purposely located at points partially shielded from wind by vegetation and terrain in order to reduce the contribution of non-wind turbine noise.***" Consequently, sound measurement equipment was not exposed to wind interference as is documented by surface wind speed recordings. (Emphasis added)

Sheltering sound and weather stations to minimize microphone wind interference is not always desirable. "Leaf noise", or more generally localized intrusive noise, potential at protected locations should be carefully evaluated at monitoring position to assure appropriate protected location representation. This should be standard practice for traffic, biological and now vegetative (during high wind speed monitoring) sources.

Correct anemometer placement for accurate ground wind speeds should be 10H from an obstructing barrier, where H is the height of the barrier.⁴

Monitoring location MP-1 is located proximal to a hedgerow of trees that artificially increases ambient noise in the immediate area during high wind conditions. Nighttime (September 4/5, 2007) wind data (Presque Isle airport, ground level METS stations, hub level measurements and RSE field observations⁵) indicate probable stable atmospheric conditions, which provided ample windmill wind speed at higher elevations and negligible surface wind near monitoring locations.

Operation noise level estimates calculated using the hourly L_{A50} introduces a statistical metric other than the hourly L_{Aeq} , which breaks step with the existing regulation, and assumes a relationship with operation sound levels that has been suggested by some data but not established under all conditions. During stable atmospheric sound measurements when hourly L_{Aeq} and L_{A50} are equivalent there is no reason to diverge from using the hourly L_{Aeq} .

⁴ Email from Rainwise Inc. Dec. 11, 2007 technical staff recommending "Guide to Meteorological Instruments and Methods of Observation". Sixth Edition 1996. Section 5.9

⁵ RSE telephone conference conversation 12/13/07.

Convincingly valid ambient noise levels have only been reported in May of 2007 during calm or light wind conditions when wind or biological sounds, such as birds or frogs, haven't potentially invalidated the integrity of the data.

Operating hourly average sound levels at site MP-1 are reported in excess of 50 dBA using either metric, *operations hourly L_{A50} - ambient hourly L_{Aeq}* **or** *operations hourly L_{Aeq} - ambient hourly L_{Aeq}* , which appears to exceed Department Regulations on Control of Noise(06-096 CMR 375.10) with operational noise limits set forth in the Control of Noise rules and the variance given in Department Order L-21635-26-A-N/L-21365-TG-B-N, dated June 1, 2004.

It is the opinion of the reviewer that this 2nd assessment of the project indicates, once again, substantial compliance, but requires further measurement technique refinement with additional measurements to fully demonstrate results that are reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise(06-096 CMR 375.10) with operational noise limits set forth in the Control of Noise rules and the variance given in Department Order L-21635-26-A-N/L-21365-TG-B-N, dated June 1, 2004.

Recommendations

Relocate anemometer and sound monitoring locations at MP-1 maintaining appropriate distances (property boundary/hedgerow distance) and similar geometry with nearby wind turbines.

Microphone wind interference should be controlled using secondary windscreens.

Operation noise levels should be reported in regulation specified metrics unless otherwise granted by the department.

Ambient (operation conditions) sound levels should be established (May 2007, calm periods or re-measured) to allow for definitive calculation of operation hourly L_{Aeq} for comparison with department compliance conditions.